U.S. ARMY 93.1

Submission of Proposals

This group of topics was originally prepared for the 92.2 SBIR publication last May. Unfortunately, there was a need to refocus the language, to better delineate what the topic author meant. We think these edited offerings describe more clearly what is required. We have also included the potential commercial market for several of the topic descriptions. Remember to contact DTIC (800) 225-3842 for additional information on these topics such as bibliographies, technical reports and information about DoD sponsored work currently in progress in the topic area. There is no direct communication possible with the topic author by law. You are welcome to call my office or the POC at the activity sponsoring the topic.

We plan to offer interim funding between Phase I and Phase II as in Solicitation 92.2. Specific instructions for the preparation of Phase II proposals will be sent to Phase I awardees by the responsible Army contracting offices at the time of award. Those Phase II applicants who wish to maintain project continuity must submit their completed proposals no later than 45 days prior to the expiration of the Phase I contract. Successful Phase II applicants may then be issued a contract modification covering a four-month interim period of performance while the Phase II contract is being negotiated. This modification can be expected to become effective at the completion of the Phase I contract, or as soon thereafter as possible. Funding for this interim period is intended to cover the start-up costs of the Phase II effort, and will not exceed a proration of the total Phase II effort as determined by the Army SBIR Program Manager.

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ARMY SMALL BUSINESS INNOVATION RESEARCH PROGRAM

Submitting Proposals on Army Topics

Phase I proposal (5 copies including 1 red-printed form) should be addressed to:

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SIMULATION, TRAINING, AND INSTRUMENTATION COMMAND (STRICOM)

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ARMY RESEARCH OFFICE (ARO)

A93-023High Dimensionality Decision Module

BALLISTICS RESEARCH LABORATORY (BRL)

A93-024High Energy Diode Laser Ignition System

HARRY DIAMOND LABORATORY (HDL)

A93-025Noise Filters

HUMAN ENGINEERING LABORATORY (HEL)

A93-026Virtual Reality Environment as Control Interface for Unmanned Ground Vehicles (UGVs)

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MATERIALS TECHNOLOGY LABORATORY (MTL)

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CONSTRUCTION ENGINEERING RESEARCH LABORATORY (CERL)

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TOPOGRAPHIC ENGINEERING CENTER (TEC)

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DEPARTMENT OF THE ARMY

FY 1993 TOPIC DESCRIPTIONS

ARMAMENTS RESEARCH, DEVELOPMENT AND ENGINEERING CENTER (ARDEC)

TOPIC: A93-001TITLE: Smart Mortar Guidance

CATEGORY: Exploratory Development

OBJECTIVE: Develop and Demonstrate Smart Mortar Munitions

DESCRIPTION: The goal of this effort would be to develop smart mortar munitions employing on-board guidance to improve accuracy and to effectively engage armor and other hard targets. Fiber optic guidance, laser designation and autonomous guidance technologies and some of the suggested approaches to providing solutions and achieve performance objectives.

Phase I: Develop mortar design methodology and formulate concepts for munition guidance sub-systems. Develop functional specifications for individual system components. Develop plans for Phase II.

Phase II: Develop laboratory prototypes and conduct tests to evaluate ability to provide surgical kill capability. Develop performance models to evaluate overall effectiveness. Develop marketing plans for both military product lines and technology spin-offs to commercial product lines.

Potential Commercial Market: The contractor is expected to successfully market products developed under Phase I and II for military supplications. As this effort part of the new DoD S&T Thrust #5, Advanced Land Combat, there is high potential or Phase III for the military market. There is some potential for foreign military sales as well as to DoD. If autonomous guidance is the principal technology there will be commercial applications in the areas of automation and robotics.

TOPIC: A93-002TITLE: Sub-Munitions with Identification Friend or Foe Capability

CATEGORY: Exploratory Development

OBJECTIVE: Develop and demonstrate advanced sub-munitions with a positive capability to identify friend or foe (IFF) to be launched by artillery, missiles (MLRS-variant) and helicopter rockets (Hellfire).

DESCRIPTION: Future weapon systems need a means of identifying friend or foe to reduce or eliminate hitting friendly forces and to increase the effectiveness (i.e. probability of kill) on the future battlefield. Advances in sensor technologies and the fusion of multiple sensor show potential to achieve this objective. This effort would demonstrate the feasibility of these technologies by devising innovative methods to acquire and identify targets while rejecting false target signatures.

Phase I: Program would develop system requirements and preliminary design concepts and a plan for development.

Phase II: Evaluate design concepts using wargame models and fabricate hardware for laboratory tests. Feasibility demonstration of munition and IFF capability will be via simulation and field tests. Develop marketing plans for both military product lines and technology spin-offs to commercial product lines.

Potential Commercial Market: The Phase II potential should be high for the military market as this effort would be a part of the DoD S&T Thrust #5 Advanced Land Combat. There is some potential for foreign military sales. Applications in the commercial include subsystems to aid in identification, security and automated manufacturing.

AVIATION SYSTEMS COMMAND (AVSCOM)

TOPIC: A93-003TITLE: Ballistic Protection for Critical Aircraft Wiring

CATEGORY: Exploratory Development

OBJECTIVE: To define and test concepts that will improve the survivability of flight critical aircraft wiring to high explosive incendiary (HEI) ballistic threats.

DESCRIPTION: Future Army aircraft will incorporate increased amounts of wiring due to more mission equipment, more aircraft survivability equipment and the introduction of fly-by-wire and fly-by-light flight control systems. Wiring systems are inherently vulnerable to HEI threats, even though survivability measures such as redundancy,masking, and separation are utilized.

Phase I: Generic ballistic protection concepts shall be defined using advanced composite materials and/or ceramics, if appropriate. Emphasis shall be placed on light weight, low cost, ease of filed installation,low flammability and chemical resistance. The concepts shall completely encase the wiring and include provisions for integration with current mounting hardware. conduct tradeoff analyses and recommend the three most promising concepts.

Phase II: Fabricate the three Phase I concepts and the Government will conduct 23 mm HEI ballistic tests to determine their ability to protect wires form damage. Conduct simple chemical test to determine each concepts capability to resistance damage by typical aviation fluids (e.g., hydraulic, JP-4, JP-5). Simple flammability tests shall be conducted to determine each concepts resistance to heat and flame without producing toxic gases.

TOPIC: A93-004TITLE: Modeling Complex Automatic Flight Controls for Helicopter Systems

CATEGORY: Exploratory Development

OBJECTIVE: Development and integration of advanced flight control modeling capabilities into comprehensive helicopter model.

DESCRIPTION: Current and future helicopters under development by the Army will rely heavily on advanced, high bandwidth, digital flight control systems to significantly enhance the mission capabilities of the aircraft. Advanced flight control synthesis techniques are being coupled with increasingly sophisticated comprehensive analytical models of helicopter structural dynamics and fluid mechanics in order to design more effective flight control systems. The Army is currently developing a Second Generation Comprehensive Helicopter Analysis System (2GCHAS) to provide significant improvements in helicopter analysis capability but it is currently restricted to simplified flight control system models.

Aircraft control and stability augmentation systems are typically depicted as block diagrams. These diagrams are representations which relate the inputs to the outputs in terms of linear, non-linear, and boolean operations. Although 2GCHAS currently has a transfer function element, it is incapable of representing complex controls systems such as that of the UH-60 Blackhawk or the AH-64 Apache. In order to model realistic aircraft control systems, engine models, hydro-mechanical units, electrical control units, and fuel control systems, only a few basic control system block diagram elements are required. The set of basic elements consists of summing junctions, product junctions,gains, table look ups, transfer functions, limiters, hysteresis, deadbands, delays, and non-linear functions such as the trig functions. Using a general multi-input/multi-output approach with this set of control elements would provide a more robust modeling system and include all the effects that the user community requires.Any approach for adding this type of capability must address the user interface as well.

Phase I: Develop a specification and conceptual design for an advanced control system model for 2GCHAS, compatible with current 2GCHAS system architecture.

Phase II: Implement an advanced flight control modeling capability for 2GCHAS using structured design methodology including software, design documents, and appropriate user manual documentation.

TOPIC: A93-005TITLE: Low-Cost Turbo Machinery Models for Aerodynamic Testing

CATEGORY: Exploratory Development

OBJECTIVE: Develop a method of fabricating a turbo machinery test article such as a small turbine rotor that would be suitable for cold-air testing and be significantly lower in cost than a conventionally-produced metal rotor.

DESCRIPTION: In order to simplify rig design requirements and instrumentation of turbo machinery test articles, overall aerodynamic performance testing is often performed at equivalent conditions rather than actual engine conditions. Such test articles still are made by metal casting or machining methods. Stereo lithography is currently being used for rapid prototyping and for providing mold in casting processes thereby shortening development time. The objective of the effort would be to explore the potential for extending that technology to fabricating rotor models suitable for aerodynamic test at equivalent conditions.

Phase I: Evaluate potential of current stereo lithography methods to produce a rotor model suitable for use in an equivalent-air test environment. Factors to be considered are cost; surface finish;dimensional accuracy and control; machinability; and structural integrity. Explore innovative ideas for improving current methods or overcoming limitations. Recommend a candidate approach to be pursued in Phase II.

Phase II: Demonstrate the approach from Phase I by applying it to several existing small turbine rotor designs ranging from axial to radial configurations. Fabricate stereo lithographic models and demonstrate structural integrity capability in a rotating test at equivalent conditions.

BELVOIR RESEARCH, DEVELOPMENT AND ENGINEERING CENTER (BRDEC)

TOPIC: A93-006TITLE: Coating Design and Evaluation Model

CATEGORY: Basic Research

OBJECTIVE: To develop a computer model for design and evaluation of multispectral coatings.

DESCRIPTION: A computer model is desired that will aid in the Army's development of coatings for countersurveillance purposes. The model should consider diffuse and spectral reflectance including bidirectional reflectance distribution function, grazing angle reflectance, wavelength dependency of reflectance properties from ultraviolet through far infrared wavelengths, and material properties of coating constituents. Model parameters are to include physical and chemical properties of coating constituents. The model must be able to run on a Microvax II (VMS), Silicon Graphics (UNIX) and/or AT compatible personal computer.

Phase I: objective is to define model parameters and algorithms and to determine feasibility of approach.

Phase II: Is to implement algorithms, demonstrate ability of model to run on stated hardware, and to debug model. Phase III is to validate the model.

Potential Commercial Market: This research could possible impact the Paint Manufacturing Industry.

TOPIC: A93-007TITLE: Accelerated Reliability Test Methodology for Environmental Control Systems

CATEGORY: Basic Research

OBJECTIVE: To develop methodologies for reliability testing of environmental control equipment which will accelerate the life characteristics of the equipment, thus reducing the amount of test time required to demonstrate a reliability value.

DESCRIPTION: Contractor will develop test methodologies, environments,and conversion factors for accelerated life testing of environmental control equipment. Current reliability test procedures will be reviewed and modified so as to accelerate the life characteristics of the equipment being tested, thus reducing test time. Conversion factors shall be developed between current test methodologies and the accelerated methodologies such that demonstrated reliability and confidence can be assessed from the accelerated test.

Phase I: The Phase I objective is to develop test methodologies,environment and conversion factors for accelerated life testing of environmental control equipment.

Phase II: Phase II is to utilize experience and lessons learned during Phase I to develop accelerated test methodologies and conversion factor for power generation equipment.

Potential Commercial Market: This research should result in reliability testing specifications for air conditioners and heaters.This could reduce the amount of time required by Industry to demonstrate reliability

COMMUNICATIONS ELECTRONICS COMMAND (CECOM)

TOPIC: A93-008TITLE: Cooperative Infrared Jamming Techniques

CATEGORY: Exploratory Development

OBJECTIVE: To develop techniques for using directional Infrared (IR) jammers and expendables cooperatively to defeat advanced IR guided missiles.

DESCRIPTION: Advanced IR missiles have been developed with the ability of resisting the effects of on-board and off-board jamming devices.Many missile systems are equipped with flare reject circuitry, and the Jamming to Signal Ratio (J/S) required using on-board jammers is very high to be effective. Techniques need to be developed that can use directional Infrared countermeasures (IRCM) devices and expendables cooperatively to enhance the overall effectiveness of the IRCM suite.Multiple launch and integration requirements with a missile warning receiver must also be considered in this evaluation.

Phase I: Evaluate IR missile technology, directable IR jammers and expendables. Determine the shortcomings of on and off-board jamming and the susceptibility of missiles to various jamming techniques.Formulate ideas of how jammers and expendables can work cooperatively.Determine time lines for these cooperative techniques.

Phase II: Develop algorithms and run computer simulations that can evaluate the effectiveness of various cooperative jamming techniques developed in Phase I. Determine the most effective techniques vs. various missile types and multiple launch scenarios. Develop a test plan for a possible Phase III live firing that would demonstrate the concept of cooperative jamming.

Potential Commercial Market: Perform a live firing to determine the effectiveness of cooperative jamming. Select various flare types and non-coherent jamming sources that can be used for a field test.Coordinate all test personnel involved in the live firing and conduct meetings to finalize the test plan and address all issues and requirements. Develop a schedule of events to meet program goals.Once testing is complete, evaluate test results and determine a best approach for each type of missile as well as a generic approach. This type of demonstration can provide a method of defeating advanced IR missiles using conventional IRCM cooperatively with flares while more sophisticated coherent source approaches are being developed.

TOPIC: A93-009TITLE: Requirements Engineering Technology Insertion

CATEGORY: Advanced Development

OBJECTIVE: Commercial availability of advanced requirements engineering technologies, techniques, and processes which have near term relevance and benefit to large scale Army software developments.

DESCRIPTION: Requirements Engineering addresses issues relating to the elicitation, validation, specification, tracing, and life cycle management of various user or system stakeholder requirements for large scale software intensive systems throughout their life cycles.This encompasses functional and non-functional requirements(constraints). The focus for this effort is relevant technology enhancement and insertion to reduce

near-term requirements related risk(cost, schedule, and quality) during the acquisition, development,acceptance, and maintenance processes. This takes into account DoD language, development, and documentation standards as well as integration into commercially available software engineering environments. Proposed efforts must demonstrate near term relevance by including endorsement from DoD project management of a specific and ongoing large scale software development or maintenance. Endorsement must reflect project management's recognition of the significance of this support as well as the willingness to provide the offeror with needed access to program documentation, personnel, and facilities.

Phase I: Identify need, opportunities, and feasibility of:1)developing, enhancing, or integrating requirements engineering technology and 2)inserting this technology into a specific system under development or maintenance. Develop a detailed plan for implementation, insertion and for measurement of benefit. The intention is that the identified system will be used as a vehicle to first define the requirements of the technology effort. The system will then be used to measure and demonstrate the benefit of the technology being developed.

Phase II: Implement the Phase I plan. Constructing a prototype which demonstrates this new technology. Demonstrate its value by performing technology insertion to support the identified system. Measure and report upon benefit of this new technology. While the technology will meet the needs of the identified system, it shall be developed to provide the ends of a broad class of systems.

Potential Commercial Market: Productive developed technology into commercially available off-the-shelf software, including user documentation, on-line help, end user support, and training courses.

TOPIC: A93-010TITLE: Management and Reuse of Software Requirements

CATEGORY: Advanced Development

OBJECTIVE: Develop a method along with automated support tools for managing software requirements to encourage domain specific software use. The proposed techniques shall support the use of the DoD standard language, Ada. The domain of interest for the phase II prototype is Army Command and Control (C2).

DESCRIPTION: The current approach to the development of DoD software intensive systems manages requirements at the system level and below;with proper automated support, software requirements could also be managed at the domain level. Extending this approach, other software assets (architectures, designs, components, etc.) and their mapping to each system implementation could also be managed at the domain level.Using such an automated system, teams defining requirements for new or improved systems would benefit from the reuse of existing requirements. In addition, developers would also benefit having access to not only assets associated with the portion of their requirements that are "reused" but also to assets associated with"similar" requirements. IF the tool could be extended to manage requirements from multiple domains, requirements and associated assets could then be reused across domains.

The automated system, or tool, should be capable of providing sufficient information for a user to determine the degree to which existing assets could be reused. The users of such a tool will have different levels of understanding of the domain; their interface to the tool should be as simple and "user friendly" as possible. The goal of this effort is to promote cost savings for the DoD by encouraging reuse, increasing software reliability and developing more efficient methods for creating intensive systems.

Phase I: This is the concept validation phase. Alternative approaches shall be investigated and if possible, a phase I demonstration should be included to illustrate how the proposed tools will automate the process. The potential CECOM user (PEOs, PMs and system developers)shall be identified during phase I. Proposals with CECOM user endorsements will be given special consideration. The only required deliverable in phase I is a final report documenting the results of the investigations and analyses and describing the selected approach in detail along with a means for estimating or measuring the merits.

Phase II: This is the prototyping phase. The approach will be refined and a prototype of the proposed automated support tool will be developed. A demonstration based on a CECOM C2 system shall be conducted to verify the method. Candidates for the demonstration shall be identified in the proposal. The prototype tool shall be delivered to the government along with a draft specification of the commercial version. Manuals to document the process and a user's guide should accompany the prototype tool set.

Potential Commercial Market: This is the commercialization phase.The developer is expected to finance this effort with non-government resources. CECOM Software Engineering Directorate may be interested in becoming a beta test site to provide government/user feedback into the commercial product.

CHEMICAL RESEARCH, DEVELOPMENT AND ENGINEERING CENTER (CRDEC)

TOPIC: A93-011TITLE: The Identification of A Non-Proprietary Mildew Inhibitor System for Particulate Filtration Media

CATEGORY: Exploratory Development

OBJECTIVE: The identification of a non-proprietary mildew inhibition system for the cellulose based filtration media of the 200 CFM Collective Protection Particulate Filter. Such an inhibitor must not degrade the effectiveness of the filter media and must not pose any health hazards to the users of the item.

DESCRIPTION: General - This effort would be to identify anon-proprietary mildew inhibition system for a filtration media conforming to the currently specified performance parameters. There is some randomness in the abilities of the current recommended sources to meet the imposed mildew resistance requirements.

Phase I: The desired result of a Phase I effort would be the identity of an appropriate milder inhibitor with supportive test data. The test procedures/parameters as described in the current edition of MIL-STD-810 would govern such exploratory efforts.

Phase II: An expansion of the phase I effort with more verification testing.

Potential Commercial Market: A mildew inhibiter would also have application to commercial particulate filters used for air pollution control and environmental hygiene.

TOPIC: A93-012TITLE: Portable Biological Aerosol Sampler

CATEGORY: Exploratory Development

OBJECTIVE: To develop a high volume, stand alone biological sampler that is capable of interfacing with existing biological agent detection technology.

DESCRIPTION: The Army has an ongoing requirement for a means of rapid detection of potentially pathogenic and toxic analytes in the field.This capability is essential to field commanders for determining an adequate level of protection of personnel. Current bio-sampling/detection technology is heavy, expensive, and available in limited numbers. The proposed study would provide an extended and flexible collection capability of field air samples at a much lower per unit cost.

Phase I: This effort would explore the feasibility of developing technology or adapting existing commercial technology for a portable self-powered aerosol sampler. The sample would impinge on or into an appropriate sampling media, such as a buffer. The unit must interface with existing detection technologies. It would be able to collect samples from a variety of environments typically encountered in the field. Contractor would be encouraged to deliver a working breadboard unit at the completion of the Phase I effort.

Phase II: This effort would develop a prototype with emphasis on weight, size, power consumption, and sampling efficiency.

Potential Commercial Market: The biological sampler would be used in conjunction with a biological agent detector for the rapid field detection of pathogens or toxins. Such a detector would have both medical and environmental applications.

TOPIC: A93-013TITLE: Development of AM1 Semi-empirical Parameters for the Group V and Group VI Elements

CATEGORY: Basic Research

OBJECTIVE: Develop AM1 semi-empirical parameters for selected elements for the Group III, V, and VI elements.

DESCRIPTION: The Neglect of Diatomic Differential Overlap (NDDO)semi-empirical molecular orbital approach has become extremely valuable in examining organic and organometallic compounds. The newest of these approaches, AM1, is finding wide-spread acceptance among many researchers from academia, industry and government. AM1 has been used very successfully to investigate properties of a large number of molecules. These results have proven valuable in predicting physical, chemical, and biological properties, and in understanding the behavior of chemical compounds. However, because this approach does rely on empirically derived parameters, many molecules containing unparameterized atoms cannot be investigated.

Phase I: Phase I of this research will begin with the retrieval of appropriate experimental data from the literature. The elements will be ordered in terms of priority. The highest priority elements for which sufficient experimental data exist will be parameterized during this phase.

Phase II: Phase II will continue the parameterization of the main group elements. The results for molecules containing elements parameterized during Phase I will be completely verified, and parameters will be developed for the
remaining elements, in descending order of priority. All parameters will be included into the most recent versions of

AMPAC and MOPAC, and released to the public domain via appropriate mechanisms. In this way, this research will benefit not only government researchers, but those in academia and the private sector as well. The final product, a greatly enhanced version of the most popular semi-empirical molecular orbital programs, will greatly assist many researchers who currently cannot employ these programs.

MISSILE COMMAND (MICOM)

TOPIC: A93-014TITLE: Integrated Three Color Sensor for Simultaneous Image Fusion

CATEGORY: Exploratory Development

OBJECTIVE: Design, Develop, and demonstrate the capability of fabricating a multispectral detector capable of simultaneous measurements of infrared radiation (0.7-12 microns) with high spatial resolution.

DESCRIPTION: The Optical Guidance Function of the Advanced Sensors Directorate is interested in the combination of co-bore sighted imagery simultaneously taken in three infrared bands (0.7 to 1.5) microns, 3 to 5 microns and 8 to 12 microns) to enhance the human detection of military target. The design of a single detector will create a common bore sight and simplify signal processing by eliminating the spatial and temporal registry of pixels associated with multiple sensors currently available.

Phase I: Identify, produce and characterize a single three color detector with the following pass bands: 0.7 to 1.5 microns, 3 to 5 microns, and 8 to 12 microns; develop architecture for simultaneous read out of each band. One or more of these goals should be addressed.

Phase II: Fabricate, test and demonstrate a full format detector array (64x64 or greater).

Potential Commercial Market: A sensor with three bands of infrared imagery, simultaneously fused and displayed, presents a unique capability of extending thermal and imaging signature analysis not currently available. Even though the sensor concept was specifically designed for military target acquisition and fire control systems, potential uses for the end product can benefit: jet engine analysis, environmental studies, law enforcement surveillance, or any application that incorporates broadband infrared radiometers.

TOPIC: A93-015TITLE: Linear Microwave Attenuator

CATEGORY: Basic Research

OBJECTIVE: Precision modulation components for use in radar simulators.

DESCRIPTION: Commercially available microwave attenuators are designed and constructed to produce equal increments in decibels(log-power) for equal increments in control voltage or current. For many signal modulations applications, it is desirable to control signal levels linearly - i.e., equal increments in signal power for equal increments in control voltage or current. The specifications for this linear attenuator are the following:
Frequency Band:1-2 GHz
Dynamic Range:30 dB, min
Resolution:0.1 % of maximum power
Control Bandwidth:1 MHz, min
Incidental Phase Shift:Less than 5 degrees over the band

Phase I: Design and build a prototype.

Phase II: Optimize, miniaturize, and build three devices for evaluation.

Potential Commercial Market: (1) Radar phased array antenna directivity control; (2) Modulation of radio frequency carrier frequencies by digital signals for digital commercial radio and television broadcasting and for digital communications; (3) electronic warfare products and simulators; (4) Radar signal simulators to test radar receiver and processor performance.

TOPIC: A93-016TITLE: Teleoperation and Unmanned Systems/Robotic Enhancements

CATEGORY: Exploratory Development

OBJECTIVE: Improvements for teleoperation, controls and autonomous capabilities for unmanned systems.

DESCRIPTION: Incorporation of artificial intelligence and improved controls to improve remote operation and teleoperation of unmanned or optionally piloted vehicles. Smart sensors, navigation techniques,control theory or unique operations that will eventually lead to autonomous systems can be incorporated on test vehicles for evaluation. Techniques are needed to improve operator control functions, display configurations and improved communication capabilities between operator and remote units.

Phase I: Efforts proposed to improve system autonomy or increase capabilities to meet mission objectives of recon, intell, surveillance and target acquisition.

Phase II: Follow on efforts to push technology to acceptable performance levels in system autonomy or simultaneous cooperative performance from multiple vehicles.

Potential Commercial Market: Applications that are currently in use, and also in development, for commercial markets in the area of unmanned systems, and supporting technologies, are as follows: (1) Unmanned, remoted, and/or teleoperated systems for the removal, transporting and handling of hazardous materials, both toxic, and nuclear; (2) Enhancements with unmanned operations in hazardous situations, such as firefighting and law enforcement; (3) Construction efforts in heavy material handling, redundant tasks associated with excavation, transportation and loading; (4) Manufacturing applications for automating facilities, redundant assembly tasks, automated manufacturing cells, and the use of factory automated guided vehicles; (5) Space and underwater applications that are better performed remotely in the areas of repairs, maintenance, construction, and exploration.

TOPIC: A93-017TITLE: A Multi-Node, Interactive, Task-Sharing, Expert-Instruction (MITE) Intelligent Tutoring System

CATEGORY: Basic Research

OBJECTIVE: This task objective is to develop and demonstrate a multi-node, interactive task-sharing, expanded (MITE) intelligent tutoring system (ITS). The MITE system will include three distributed nodes integrated for tutoring and training in a shared problem solving environment. The MITE system will be demonstrated with two integrated modes of operation; ITS mode, and TEAM mode. The ITS mode will provide full ITS operation for individual students. The TEAM mode has two options for shared problem solving; Full-Up Mode (FM) with students using the terminals, and a Pseudo-Student Mode (PM) with a student model replacing a human student at one of the three nodes.

DESCRIPTION: A modular architecture will be developed for the MITE system that integrates operation of ITS for individual tutoring, and training in a shared task problem solving environment. The ITS will be modular with replaceable code units identified for top level module, i.e., man-machine interface, diagnostic module, instructional module, and expertise module. The MITE system will be developed for networked personal computers (PC)(386 or better) with Windows 3.0 or equivalent memory extensions. The NASA CLIPS software will be used as a development environment.

The MITE operation in the ITS mode will evolve and mature a high fidelity student model that reflects the knowledge and skills of the student regarding the problem solving domain. The student model should evolve in size and complexity as the student's knowledge and skills increase. The student model contents must be capable of input/out from floppy disks. The ITS mode will allow the student to engage in any and all parts of the problems used in the team mode of operation.

The TEAM mode will allow students of varying levels of expertise to jointly engage in task sharing activities during a problem solving exercise. As the student's expertise changes the nature and complexity of that individuals shared task operation will change.During FM operation the individual's student model will continue to be populated with information on the student's action. Information recorded on students choices and actions will be used to tutor the student on missed concepts and misapplied actions in the ITS mode.

The Pseudo-Student mode (PM) will allow the same problem domain operation as in the FM mode. The PM operation will allow a student model, as evolved in the ITS mode, to replace a student's operation atone of MITE's nodes. Any resulting change in expertise levels will cause changes in task assignments for all nodes as appropriate for achieving task objectives.

Phase I: An architecture will be identified for development and integrated operations of the MITE system in all modes; ITS,TEAM FM,and TEAM PM. The MITE system will be developed for networked personal computers (PC)(386 or better) with Windows 3.0 or equivalent memory extensions. The primary development software environment will be NASACLIPS software unless task analysis provides demonstratable results that other software environments would be required to meet MITE system objectives. Three separate problems will be identified that are applicable for MITE task sharing problem solving domain. An early prototype of a one node operation of the MITE system will be developed for concept demonstrated for delivery in the Phase I effort.

Phase II: A three node MITE intelligent tutoring system will be developed, demonstrated and delivered to the federal government. All modes, ITS, TEAM FM and TEAM PM of MITE system operation will be demonstrated. At least two task sharing problems will be included in the demonstration. Complete documentation will be provided on knowledge acquisition accomplished for the ITS knowledge bases,cognitive and simulation modeling for tutoring, training and task sharing operation.

Potential Commercial Market: The MITE System would be applicable in areas requiring highly trained individuals working as a team, such as operators of nuclear power plants and emergency management teams. Individual nodes of Mite would be applicable for individualized training in classrooms, training at remote sites and isolated locations.

TOPIC: A93-018TITLE: Large Dynamic Range Camera

CATEGORY: Exploratory Development

OBJECTIVE: To develop a camera based on currently available CCDs with a large dynamic range and a 60 Hz frame rate.

DESCRIPTION: A camera with a dynamic range in excess of 20,000:1 is required to serve as the detector in an optical correlator. The device must have a frame rate of at least 60 Hz and a resolution of at least 512 x 512 pixels. It is anticipated that a CCD array would be used; however, other technologies may be considered.

Phase I: The objective of Phase I is to determine the most feasible technology (i.e., CCD, vidicon, etc.) to use in designing a camera with the detailed requirements. A final design and a prototype should be completed in this phase.

Phase II: In Phase II the final camera will be built which will incorporate any corrections made when building the prototype.

Potential Commercial Market: The requested large dynamic range camera has commercial potential in markets where the region of interest contains objects with widely varying illumination. Applications where the scene has objects of interest in both dark shadows and bright sunlight would be one example of where this camera would find widespread use.

TOPIC: A93-019TITLE: Bacteriorhodopsin Spatial Light Modulator

CATEGORY: Exploratory Development

OBJECTIVE: To develop an erasable, re-writable spatial light modulator based upon the optically active bacterial extract called bacteriorhodopsin.

DESCRIPTION: Spatial light modulators of high spatial resolution and good optical sensitivity are required for applications of optics to automatic target recognition and optical computing. The bacterial extract, bacteriorhodopsin, has high inherent speed and sensitivity in a reaction that causes it to change color when exposed to certain wavelengths of light. This effect shows promise as the basis for a fast and efficient spatial light modulator.

Phase I: The objective of Phase I is to fabricate a bacteriorhodopsin film of high optical quality, and to characterize its performance in terms of sensitivity, spatial resolution, and useful lifetime in terms of write/erase cycles.

Phase II: In Phase II, a working spatial light modulator will be fabricated with dimensions such that it may be placed in an existing optical correlator (target recognition device) for system testing.

Potential Commercial Market: The potential commercial market for bacteriorhodopsin spatial light modulators is unknown.

TANK-AUTOMOTIVE COMMAND (TACOM)

TOPIC: A93-020TITLE: Real Time Integrity/Durability Monitoring of Composite Structures

CATEGORY: Exploratory Development

OBJECTIVE: Develop the architecture for a neural network to collect data from sensors, in real-time, to monitor the structural health of a vehicle from cradle to grave.

DESCRIPTION: A composite structure reflects its history back to the point of manufacture. Details such as improper cure, dings, impacts,and duty cycle all accumulate with time. The soundness of a composite structure cannot be visually inspected, oftentimes the damage is detectable only to the trained technician. A means by which to monitor the structural health of a vehicle prior to or during operation must be developed.

Phase I: Develop a system architecture for a neural network to interconnect sensors embedded within a composite structure. The system must possess redundancy to avoid the loss of valuable input due to damage from munitions.

Phase II: Construct a thick section composite panel with embedded sensors. Interconnect the sensors using the network developed in Phase I and conduct both structural and ballistic testing to determine the effectiveness of the design.

Potential Commercial Market: One of the reasons composite materials have not been used as much in primary load carrying members is the lack of a reliable means to determine the structural health of components. A company that developed and provided the feasibility of such a technology would be in a good position to sell this technology to the government as well as private aircraft industry.

TEST AND EVALUATION COMMAND (TECOM)

TOPIC: A93-021TITLE: Vehicle Magnetic Signature Image Enhancement

CATEGORY: Advanced Development

OBJECTIVE: Develop a software system for visually displaying magnetic field strengths about a vehicle silhouette.

DESCRIPTION: Ground vehicles, especially armored vehicles, cause changes in the magnetic field around them as they move. This magnetic field can be measured at various points and a time history of the magnetic field recorded. There is a need to integrate data from many sensors into a group of visual images that show lines of constant magnetic field strength. The basic techniques of how this could be done needs to be explored and sample displays generated from actual test data. Potential commercial use: unknown.

Phase I: Explore techniques and propose a display capability.

Phase II: Initiate a software system for visually displaying magnetic field strengths about a vehicle silhouette.

SIMULATION, TRAINING, AND INSTRUMENTATION COMMAND (STRICOM)

TOPIC: A93-022TITLE: Simulator/Simulation Based Intelligent Tutoring Systems (ITS)

CATEGORY: Basic Research

OBJECTIVE: Develop the next generation ITSs for training device simulators and simulations.

DESCRIPTION: The Project Manager for Training Devices (PM TRADE)principle mission is transforming training device requirements into systems that embody the essential characteristics of the requirements and permits the Army to accomplish its training mission in an effective manner. These systems take the form of both stand - alone and embedded trainers which almost always use simulation to achieve the training objectives. Training devices and simulators have proven to be an effective tool in transferring information over a broad range of applications. ITSs are an emerging technology field that is gaining visibility within the Army as evidenced by its recognition as the artificial intelligence (AI) subtechnologies broken out for emphasis in the U.S. Army Materiel Command's AI Technology Master Plan(AIMP). Whereas the AIMP promotes a broad based research vision for ITS technology, PM TRADE chooses to focus ITS research efforts in two(2) principle areas that more closely support its mission: ITSs that incorporate existing simulations into the ITS architecture; and ITSs that are constrained to include simulators/simulations as a component of the ITS design. The distinction between the two areas is subtle but crucial, i.e., in the former case the ITS design must adapt to incorporate a "fixed" simulator/simulation into the architecture and in the latter case a simulator/simulation is an a prior "free" design element under the ITS designer's control. An effective ITS development strategy addresses the ITS architectural and functional component design issues for the two (2) areas first in the context of individual training and then extending those results to the crew/team/combined arms training situations. A ITS testbed would be a key element of any ITS development strategy on which to verify and validate ITS architectures and functional component models. A potentially robust and effective functional ITS architecture has been developed by the RD&E Center of

U.S. Army Missile Command in Huntsville, Alabama in support of the Intelligent Embedded Operator Assistant (IEOA) project.

Phase I: Develop ITS architectures, functional component designs/models, and/or test beds

Phase II: Implement architectures, designs/models, and/or test bed design to establish feasibility

Potential Commercial Market: It is anticipated the technology developed under this topic will transfer into the educational and commercial training sectors, especially for those applications for which the knowledge na process tasks to be trained have been appropriately modelled.

ARMY RESEARCH OFFICE (ARO)

TOPIC: A93-023TITLE: High Dimensionality Decision Module

CATEGORY: Basic Research

OBJECTIVE: Design and analyze a hardware decision module for electronic vision system applications.

DESCRIPTION: A hardware, universal decision module implementing neural-net like algorithms is envisioned for making fast,minimum-probability-of-error decisions in high dimensionality,multi-sensor feature spaces. The decision module must analyze high dimensionality, multi-sensor feature space data of at least ten variables, dynamically adapt to novel and changing environments often in the time of a single video field, be trainable at video field rates using training sets with thousand of data points, and provide decisions at video pixel rates. The decision module will be used in multi-sensor electronic vision systems which perform tasks such as fusing, segmentation, recognition as well as sensor or platform control decisions. In addition to vision systems, this module will be applicable to many other control systems; for example, manufacturing and transportation systems. Any control system in which complex decisions are required may benefit from this work.

Phase I: Complete the design and analysis of a candidate system including simulation of performance bounds.

Phase II: Define the design and implement a demonstration system. Run performance experiments on both synthetic and real vision data.

Potential Commercial Market: In addition to vision systems, this module will be applicable to control systems in manufacturing and transportation, and elsewhere that complex control decisions are required.

BALLISTICS RESEARCH LABORATORY (BRL)

TOPIC: A93-024TITLE: High Energy Diode Laser Ignition System

CATEGORY: Exploratory Development

OBJECTIVE: Develop Extremely Small High-Energy Diode Lasers, Diode Laser Arrays and Diode Laser-Pumped solid State Laser Systems for the Ignition of Energetic Materials.

DESCRIPTION: The design and construction of extremely small high-energy diode laser systems for the ignition of pyrotechnics, igniter materials and propellants used in large caliber gun is required.

Diode lasers possess the desirable attributes of complete solid-state construction with no moving components, are extremely small and are capable of delivering high energies through optical fibers.

The integration diode laser technology for the initiation of energetic materials, explosives and propellants will therefore have a major impact on the DoD community. The design and construction of both 1) a diode laser or diode laser array and 2) a diode laser pumped solid-state laser such as Nd: YAG or Ti-Sapphire are needed to ignite pyrotechnics, black powder and solid propellants used in large caliber gun. Desirable specifications are 1 Joule of energy per single 10 ms pulse, optical fiber output and compactness (8x4x4 in, all electronics and components).

Phase I: An engineering and design study which will attempt to meet the aforementioned specifications. The delivery of a simple prototype single diode laser based system is desirable.

Phase II: Construction of both diode laser-based ignition systems as described above and delivery to BRL for test and evaluation.

Potential Commercial Market: Production of commercially marketable diode laser initiation systems for application in both DoD and industrial sectors by contractor is expected.

HARRY DIAMOND LABORATORY (HDL)

TOPIC: A93-025TITLE: Noise Filters

CATEGORY: Exploratory Development

OBJECTIVE: To explore the utility of adaptive techniques based on explicit characterization of interfering sounds in the design and development of robust acoustic detection and classification.

DESCRIPTION: Previous work has shown that with proper adaptive learning schemes, interfering acoustic signals (which tend to obscure or be misrecognized as one of the desired acoustic signatures) can be automatically identified, characterized, compared to and deleted from an incoming acoustic data stream. This process exposes a desired signature buried in a very obscure environment. In a typical use of this approach, sounds that tend to obscure or be misrecognized as a desired signature, are fashioned, both during training and on the fly,into templates defining error classes. These templates are then used to identify and suppress signals form the error classes, leaving a residual with improved SNR for template matching against reference templates. Systems containing sensitivity in poorly understood and rapidly changing acoustic environments by reducing recurrent false positives, while permitting retrofit implementation on template matching systems currently in use.

Phase I: Proof of concept. Develop and code algorithms and exercise in a suitable simulation testbed. Effort focused on demonstrating ability to perform detection and upon classification accuracy, rather than on real time performance.

Phase II: Technology Demonstrator. Optimize and implement the Phase I designs using hardware appropriate for responsive real time decision making performance. Demonstrate effectiveness in a setting in which selected cultural sounds are discriminated in low and variable signal-to-noise and signal-to-clutter ratios.

Potential Commercial Market: (1) Robotics; (2) Medical: Auditory Speech Recognition; (3) Acoustic Medical Responses.

HUMAN ENGINEERING LABORATORY (HEL)

TOPIC: A93-026TITLE: Virtual Reality Environment as Control Interface for Unmanned Ground Vehicles (UGVs)

CATEGORY: Exploratory Development

OBJECTIVE: Develop a virtual reality environment control interface for operation and simulation of operation of robotic unmanned ground vehicles (UGVs).

DESCRIPTION: The teleoperation of UGVs requires a control interface which may be used by a human operator with as few difficulties as human factors allow. Choosing a suitable control interface requires determination, through human factors studies, of limitations and preferences of human operators for operation of an UGV. A problem arises in the study of these human factors in that existing control interfaces can not be easily reconfigured to isolate individual interface elements for these human factors studies to be performed.One solution to this problem is to have a virtual reality environment with features that allow a human operator to teleoperate a vehicle from within the environment. A non-inclusive list of features includes stereo vision, tactile feedback (for direct manipulation of interface element representations), graphics/real-time video composite imaging. This virtual reality environment would also be used as the final control interface for UGVs.

Phase I: This phase shall establish hardware and software requirements for the development of the virtual reality environment control interface described above. These requirements shall include a description of the overall system design strategy to develop a virtual reality environment control interface which includes such feedback mechanisms as stereo vision, tactile feedback, and graphics/real-time video composite imaging. Other design requirements are the commercial availability of necessary system components (both hardware and software), and cost. The final output of Phase I shall be a report defining the feasibility of achieving requirements and suggested alternative solutions where requirements are unachievable.

Phase II: This phase shall be directed towards fabricating an operating prototype of the virtual reality environment control interface to be used in human factors studies of the teleoperation of UGVs.

Potential Commercial Market: The commercial applications of a developed virtual reality environment as control interface for UGVs could include, while not excluding others, a single generic reconfigurable control interface which could operate a variety of teleoperated platforms ranging from such machines as industrial robotic manipulator arms to wheeled/tracked mobile surveillance vehicles to heavy construction vehicles/equipment. In industrial situations, a single or few interfaces could be used to operate many different systems. An additional area of commercial application would be the simulation for platform operation or the simulation of dangerous environments for the purposes of training personnel such as police, firemen, hazardous materials handlers, bomb disposal specialists, as well as others.

TOPIC: A93-027TITLE: Development of an Auditory Signal Processing System

CATEGORY: Advanced Development

OBJECTIVE: To develop a hardware/software system that will enhance auditory signals which are degraded by noise.

DESCRIPTION: The advancement of dedicated signal processing integrated circuits has made possible the processing of auditory signals in real-time. There is a need in the Army for a processor that will recover, in real-time, signals which are embedded in noise. These signals include speech signals which may be either airborne or
transmitted over communication systems, or may be combat related sounds. Field use of the processor may require that it be worn unobtrusively, therefore consideration should be made for future miniaturization of the device.

Phase I: Phase I of this project will include the selection or development of the signal enhancement algorithm(s). It will also include the definition of the hardware required to implement the selected algorithm(s) and the definition and outline of the software that will be written to implement the signal processor. Phase I will also provide an indication, through a demonstration, that the concept has a reasonable chance of succeeding.

Phase II: Phase II will require a hardware system and software for the auditory signal processor. Phase II will also include extensive human subject evaluation of the processor to optimize its capabilities and to demonstrate the ability of the system to enhance degraded speech and other signals. Both the signals and the noise will have varying spectral and temporal characteristics. Phase II will also address miniaturization of the processor.

Potential Commercial Market: Hearing aid manufacturers and telephone companies.

MATERIALS TECHNOLOGY LABORATORY (MTL)

TOPIC: A93-028TITLE: Nondestructive Evaluation Method for Environmental Deterioration of Fiber-Reinforced Organic Matrix Composites

CATEGORY: Exploratory Development

OBJECTIVE: Develop a spectroscopic, or equally effective,nondestructive evaluation (NDE) system to evaluate the environmental durability of fiber-reinforced, organic matrix composites.

DESCRIPTION: The structural behavior of advanced composite materials and structures is known to be affected by natural/accelerated weathering and other in-service environmental/loading conditions.Material deterioration occurs via a combination of temperature,humidity, service loads, and photothermal and photo-oxidative mechanisms. This results in chemical changes, plasticization of the resin, fiber blooming, fiber/matrix debonding, microcracking, lowering of the glass transition temperature of the matrix, and a reduction of the mechanical properties. The degree of degradation depends on the severity and duration of environmental exposure, loading conditions,and the type of composite and coating. An NDE technique is needed to assess the level of deterioration of organic-based materials in the field and for predicting the lifetime of critical high-performance composite structures used in Army systems. The proposed spectroscopic system must be practical, field-portable, environmentally safe and not affect the structural performance of the composite.

Phase I: Demonstrate the feasibility of characterizing the moisture effects and chemical changes that result from natural and/or accelerated weathering of fiber-reinforced organic matrix composites.This demonstration should employ a spectroscopic or equally effective NDI technique and evaluate these effects in fiberglass, Kevlar, and graphite reinforced composites with both epoxy and polyester matrices.

Phase II: Develop and deliver an optimized, automated,field-portable, prototype of the spectroscopic NDE system addressed in Phase I. Demonstrate the capability of this prototype to assess environmental deterioration on full-scale composite structures used in Army systems.

Potential Commercial Market: A new automated non-destructive evaluation system to assess the environmental deterioration of composite structures in military and commercial markets.

CONSTRUCTION ENGINEERING RESEARCH LABORATORY (CERL)

TOPIC: A93-029TITLE: Construction and Rehab Materials Made From Recycled Post-Consumer Wastes

CATEGORY: Exploratory Development

OBJECTIVE: The objectives of this effort are: (1) to assess the opportunities for the development of innovative construction materials from recycled waste products and (2) to manufacture and demonstrate selected innovative construction material systems that have a high potential for success.

DESCRIPTION: Due to the volume of waste materials being sent for disposal, our landfills are being filled at a critical rate. Soon we will have no place to put our garbage. This situation has generated increased recycling efforts across the Nation. However, for there cycling process to be successful, there must be a market or outlet for the recycled "raw" materials. Many times the recycled material can not be used in the same manner as the virgin material. The potential exists, however, for these recycled "raw" materials to be utilized as a construction and/or rehab material. Plastics, paper (e.g., newspaper, telephone books and magazines) and byproduct materials like fly ash comprise a significant fraction of the total waste volume. The above mentioned materials have been used to some extent to produce other products such as plastic lumber,building insulation and concrete. The potential raw material volume can support many other uses of these recycled waste materials.Innovative construction material systems are needed that make optimum use of these waste materials yet produce equal or superior materials for the construction and/or rehab of facilities. Fiber reinforced composites made from recycled plastics or lightweight construction blocks/bricks made from fly ash are possible examples.

Phase I: Analyze and assess the opportunities for the development of various construction materials made from recycled waste products.

Phase II: Manufacture selected materials that show the most promise and demonstrate their performance in a constructed facility.

Potential Commercial Market: With the increasing National emphasis on the use of recycled materials for just about everything, the market potential for successfully developed new and innovative construction materials made with recycled wastes is high.

TOPOGRAPHIC ENGINEERING CENTER (TEC)

TOPIC: A93-030TITLE: Texture Library for 3-Dimensional Visualization Systems

CATEGORY: Exploratory Development

OBJECTIVE: Develop an effective approach to create and populate a common texture library for use in simulators, training devices,mission rehearsal systems and weapon systems under development.

DESCRIPTION: The use of simulators and image generators in the Army for a variety of tasks, including training and mission rehearsal is rapidly growing. To be effective, these systems require a high degree of realism in the computer generated scenes. Increased detail of 3D models, objects, and local features (both natural phenomena and cultural features, such as water bodies, grassland, forest, crops,road surfaces, buildings, etc.) shown in these scenes could be accomplished through rapid retrieval of color texture patterns stored in a digital library for subsequent use. The library approach will help eliminate the need for individual Army systems to generate texture libraries and promote common understanding of the computer generated scenes.

Phase I: Study existing methods of graphics texturing, including fractal, statistical, locally controlled, context-sensitive, and photo-derived techniques for modulating the color of 3D models,objects, and local features shown in 3D computer generated scenes.Devise a classification scheme for a texture library based on texturing methods and object types. Develop a method for creating a digital library of textures, addressing issues such as algorithms for creating mathematical based textures and image compression techniques for storage and retrieval to and from the library. The effort should culminate in a report on texturing methods and compression techniques,and include a recommended design approach for a texture library.

Phase II: Populate and deliver a texture library on a suitable storage media.

Potential Commercial Market: Phase III potential should be high. The texture library should be a product with strong need in the rapidly growing DoD modelling and stimulation community and in commercial advertising and civil engineering business sectors.

TOPIC: A93-031TITLE: Development of a Surface Microroughness Compilation

CATEGORY: Exploratory Development

OBJECTIVE: Develop a strategy for compilation of surface microroughness for input to the Condensed Army Mobility Modeling System (CAMMS).

DESCRIPTION: The Army currently uses inference techniques to estimate the surface microroughness of a geographic area. These techniques are necessarily less accurate than if the Defense Mapping Agency provided the information directly from source imagery.

Phase I: Identify one or more compilation strategies that could be implemented in the DPS environment to reliably extract surface microroughness.

Phase II: Extend this strategy worldwide.

Potential Commercial Market: Phase III potential should be good for marketing this product to both domestic and foreign defense customers and for private sector firms that design military vehicles.

MEDICAL RESEARCH ACQUISITION ACTIVITY (MEDICAL)

TOPIC: A93-032TITLE: Neurotoxins

CATEGORY: Basic Research

OBJECTIVE: Identify appropriate model systems for the study of agent effects and investigate countermeasure approached for neurotoxins such as botulinum toxin and saxitoxin. Identify antibodies (antitoxins)directed against common features of neurotoxin molecules that in themselves do not have central nervous system side effects. Develop reagents that rapidly identify neurotoxins either specifically or as members of a neurotoxin class.

DESCRIPTION: After conducting a thorough literature search, use novel techniques to investigate the mechanisms of action of neurotoxin damage. Investigate pre/treatment regimens.

Phase I: Preliminary data that will show the concept feasibility and their merit of further investigation.

Phase II: Experimentation that will demonstrate the practicality of the research as it relates to military medical defense.

Potential Commercial Market: Several militarily relevant toxins (e.g.,saxitoxin, botulinum toxin) present significant public health hazards through oral ingestion. No specific treatment regime exists. Model systems for studying these agents resulting in antitoxins for treatment against these toxins would be a significant advance in protecting the public health.

TOPIC: A93-033TITLE: A Transducer/Equipment System for Capturing Speech Information for Subsequent Processing by Computer Systems

CATEGORY: Exploratory Development

OBJECTIVE: Develop, optimize, and test a noise-canceling (or superior) transducer/equipment system to capture high quality speech information from active soldiers i the field for subsequent processing by computer systems.

DESCRIPTION: Specifically, this noise-canceling transducer/-equipment system must yield high quality speech information under the following conditions: 1) High level ambient noises, e.g., 100 db, 2)High-intensity impulse acoustic noises, e.g., firing of tank or howitzer, 3) Sensing speech from soldiers who are physically active,4) High ambient environmental temperatures and humidities, e.g., 38 degrees centigrade and 90% r.h., 5) Pulsed and continuous e-m noise from computers, radios, radars, 6) Sensing speech from soldiers wearing various helmets and clothing systems which restrict options for transducer attachment and placement, e.g., MOPP1 versus MOPP4, 7) The transducer/equipment system must be relatively non-invasive and comfortable for the soldier to wear for 12-15 hours, and 8) The system can not use electrical power from an external source. Soldiers will answer queries about symptoms, well-being, or perceived capabilities while they are performing their duties. Also, measures of operational performance for military tasks involving communications such as requested for fire support or sending of planned target lists will be collected by computer systems. Thus, demonstrating the feasibility of this transducer/equipment system is a necessary and critical "first step" towards the ultimate application of computer systems to collect and analyze symptoms, moods, and performance data from soldiers in real-time in training centers, the laboratory, and the field with minimal interference to ongoing soldier activities.

Phase I: To the extent possible, design and assemble a noise-canceling (or superior) transducer/equipment system from off-the-shelf previously evaluated components to faithfully sense speech in the laboratory for the conditions described above. Fabricate new or modify existing components as needed. Demonstrate proof of concept of r the proposed system by laboratory test and provide documentation describing methodology and test results.

Phase II: Optimize, assemble, and test a noise-canceling (or superior) transducer/equipment system that can be worn by the soldier,which includes high quality, high level (0.2V) audio output, an earphone (so that researchers can communicate with the soldier), and an interface for connection to other existing audio data collection and audio communications equipment. The feasibility and performance of this transducer/equipment system will be demonstrated by technical documentation and a field test that shows high quality speech information can be acquired, recorded and processed under realistic conditions described above. Deliver a functional prototype system for further evaluation and testing by Government personnel.

Potential Commercial Market: Products of this research would have a broad-based commercialization potential for application in management of any activity or operation controlled by a computer. Most specific applications would be in noisy operating environments, such as in industry, in which data input is required through computer technology in controlling operations.

TOPIC: A93-034TITLE: Instrumentation For Measurement Of Body Chemical Element Content

CATEGORY: Exploratory Development

OBJECTIVE: Fabricate and test a device to measure amount and distribution of nitrogen and calcium by scanning the entire human body.

DESCRIPTION: A requirement exists for new research instrumentation to make rapid, precise, in vivo measurements of human body chemical element content using new nuclear techniques. Such instrumentation should allow rapid, routine assessment of nitrogen and calcium content in individual soldiers. Any radiation dose associated with proposed instruments should be low enough that serial measurements will be possible with a low risk to the subject. In addition, proposed instruments should not have unusual power requirements and should be sufficiently compact to be transportable. The possibility of measuring element distribution in the body with centimeter-scale resolution should also be addressed.

Phase I: Develop a viable device and collect sufficient laboratory test data to demonstrate feasibility.

Phase II: Construct and test a working prototype; demonstrate the required operational capability in the laboratory; deliver a transportable system suitable for government field testing.

Potential Commercial Market: Moderately high for instrumentation capable of monitoring body composition changes, with particular relevancy in the areas of nutritional status evaluation of an individual, and in the application area of sports medicine. In addition, monitoring of body homeostasis with regard to calcium content has specific relevancy to evaluation and treatment of women suffering from osteoporosis and related bone diseases.

STRATEGIC DEFENSE COMMAND (SDC)

TOPIC: A93-035TITLE: Performance Upgrade Kit for AN/MPS-36 Radars

CATEGORY: Basic Research

OBJECTIVE: Improve performance of AN/MPS-36 Tracking Radars via Kit Type Modifications.

DESCRIPTION: The AN/MPS-36 tracking radar is in use at several test ranges. Although piecemeal upgrades to individual An/MPS-36 radars have been made, it is desirable to lower the per-radar non-recurring engineering cost by developing a modification kit. The kit should at minimum alleviate spiraling and crosstalk problems associated with the AN/MPS-36 radars. Ideally, the kit will improve reflector characteristics and use state of the art technology to upgrade feed/receiver subsystems.

Phase I: Phase I will prove/disprove concept feasibility, outline design and test methodologies, present the Phase II project management philosophy and provide a rough order of magnitude cost for kit prototyping and production.

Phase II: Phase II will result in the production of a prototype kit,and include installation and testing of the kit on one of the Kwajalein Missile Range (KMR) AN/MPS-36 radars. Phase II proposals should also include an assessment of commercial markets for the radar modification kit.

Potential Commercial Market: Anticipated benefits/commercial applications could aid the NASA community in tracking and identifying space debris.

TOPIC: A93-036TITLE: Transmitter Upgrade Kit for AN/FPQ-19 Radars

CATEGORY: Advanced Development

OBJECTIVE: Improve multiple beacon Tracking Capability

DESCRIPTION: An ability to utilize the An/FPQ-19 for tracking multiple beacons having different up and down-link frequencies will ease Kwajalein Missile Range sensor allocation constraints. One of the modifications necessary to accomplish effective multiple beacon tracking is an ability to digitally tune the transmitter to any point

within its 500 Mhz bandwidth. tuning to any frequency must be accomplished rapidly, with a tuning time less than the maximum pulse repetition frequency being desirable. The transmitter modification should be in kit form, and be suitable for installation on similar radars with minimal modification.

Phase I: Phase I will prove/disprove concept feasibility, outline design and test methodologies, present the Phase II project management philosophy and provide a rough order of magnitude cost for kit prototyping and production.

Phase II: Phase II will result in the production of a prototype kit,and include installation and testing of the kit on the KMR AN/FPQ-19 radar. Phase II proposals should also include an assessment of commercial markets for the radar modification kit.